

# KEYENCE

**NEW** Safety Laser Scanner  
SZ Series

Maximum safety standard for scanners

**Type3** **SIL2** **Category3** **PLd**



## World's Smallest

TYPE 3 SAFETY LASER SCANNER

## Up to 48 Zones



Select from 3 different models for your application

Simple function (SZ-01S)

Multi-function (SZ-04M)

Multi-zone sets (banks) (SZ-16V)

Incredibly small, versatile, and affordable

World's  
smallest

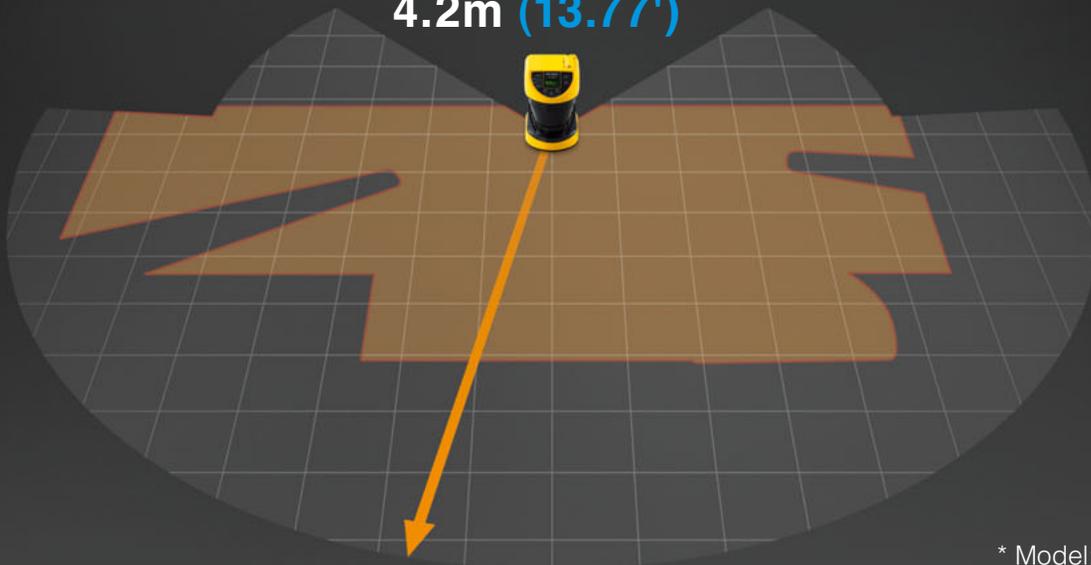
Die-cast  
body



Industry's First

16 protection zones & 32 warning zones  
(48 total) can be configured.\*

Maximum protection zone  
**4.2m (13.77')**



\* Model: SZ-16V only

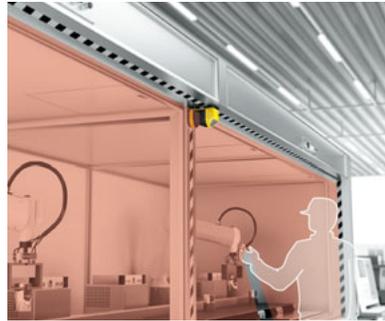
**See P.4** **Area Protection**

A safety laser scanner allows users to configure protection zones anywhere, even in complex-shaped zones.



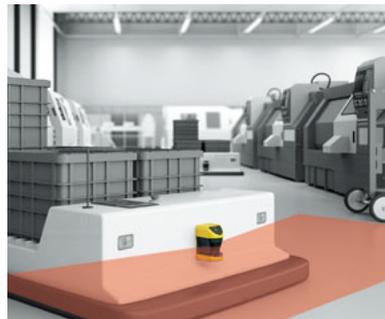
**See P.6** **Access Protection**

A safety laser scanner is easy to install. Side-mounted installation significantly reduces labor related to beam axis adjustment and wiring.



**See P.8** **Collision Prevention**

A safety laser scanner can be mounted on an automated guide vehicle. The following three area settings are available: slow area, stop area, and emergency stop area. SZ-16V users can configure up to 16 different zone sets, each consisting of unique slow, stop, and emergency stop area settings for a total of 48 zones.



**NEW**

Safety Laser Scanner  
SZ Series

**3 models available according to the application**

Simple function type SZ-01S

Multi-function type SZ-04M

Multi-zone sets (banks) type SZ-16V

# Area Protection

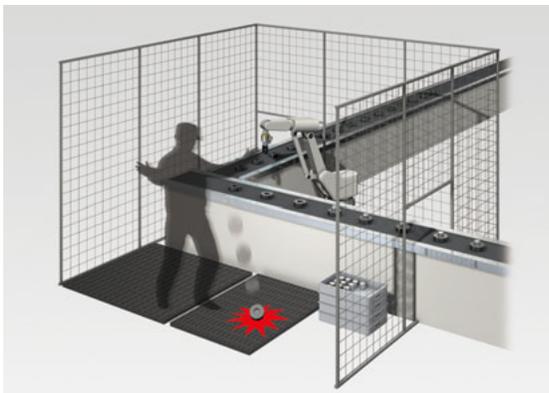
A type 3 safety laser scanner allows users to easily configure protection zones.



## Configure zones anywhere and save space

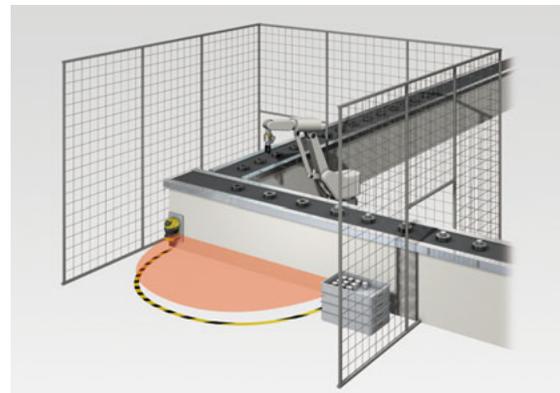
AREA PROTECTION - CONVENTIONAL METHOD VS. SZ SERIES METHOD

### Safety Mat



- A safety mat may break if something heavy or sharp drops on it
- Having to stock different sized mats can be cumbersome
- Change in the facility layout can make safety mats unusable
- Not easy to move due to its heavy weight
- Only rectangular shapes can be covered in the protection zone

### SZ Series



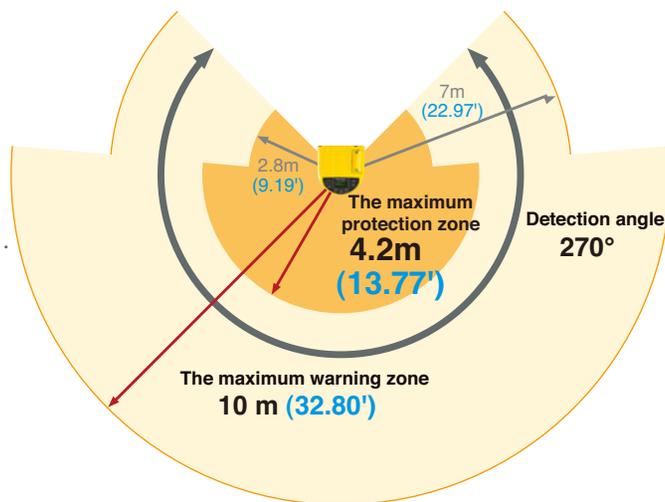
- Non-contact detection is free from damage caused by falling objects or vehicle traffic
- No need to stock different size mats
- Protection zones easily modified for workspace layout changes
- Easy to move due to its compact body and light weight
- Complex-shaped zones can be configured

## Easily configure zones with a safety laser scanner

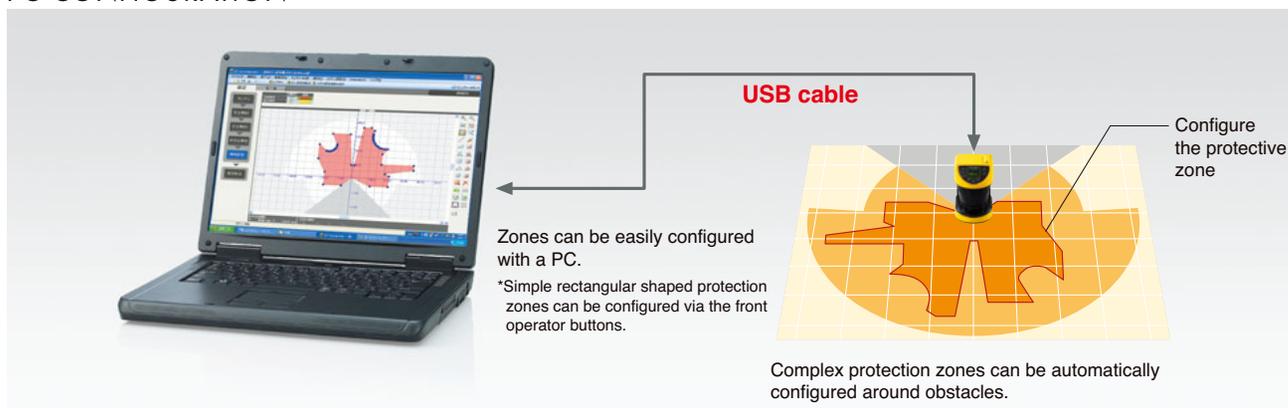
SZ-01S SZ-04M SZ-16V

A laser scanner can be installed anywhere since protection zones and/or warning zones can be easily configured for dangerous areas. Despite its compact body, the SZ Series has a maximum protection zone of 13.77' 4.2m and a maximum warning zone of 32.80' 10 m.

ZONE CONFIGURATION.....



PC CONFIGURATION

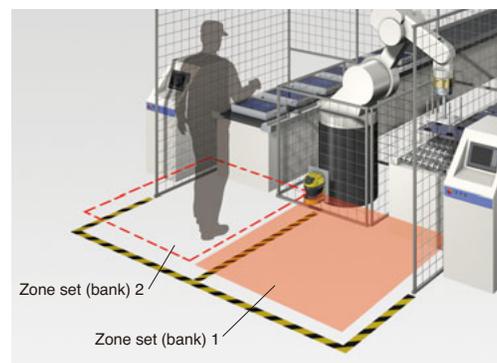


## Multiple protection zones/warning zones can be switched

SZ-04M SZ-16V

Multiple zones (protection zones/warning zones) can be selected via remote input. For example, in the image on the right, the zone set is selected via feedback on the robot's position.

\* SZ-04M: 4 zone sets (banks) SZ-16V: 16 zone sets (banks)



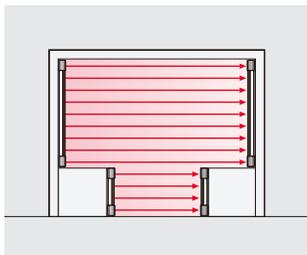


The SZ-16V (Multi-zone set type) is not equipped with the Reference Point Monitoring function.

## Simple installation covers complex-shaped zones

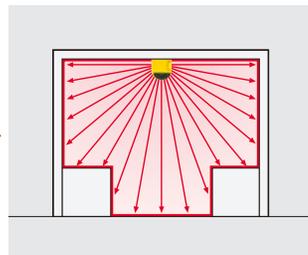
ACCESS PROTECTION - CONVENTIONAL METHOD VS. THE SZ SERIES METHOD

### Light curtain



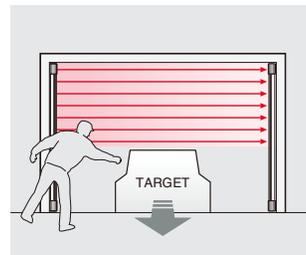
- Installation was difficult due to the clearance of a complex shape.
- The transmitter and receiver required it be installed on both sides.

### SZ Series



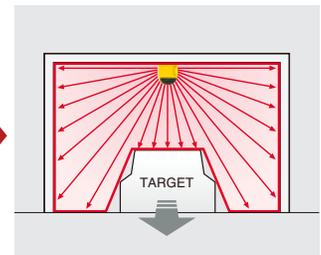
- The SZ Series can be freely configured to protect clearances of any shape.

### Light curtain



- The Muting function could nullify an area that requires protection.

### SZ Series



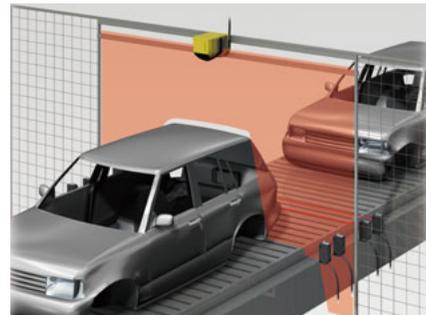
- Safety is increased by minimizing the dead zone caused by the Muting function.

## First laser scanner with a built-in Muting function

Industry's First

SZ-04M

Similar to KEYENCE SL-V Series safety light curtains, muting sensors signal the scanner to ignore certain areas of the protection zone to allow passage of a target. However, unlike light curtains, muting the scanner results in a much tighter protection zone, minimizing dead zones around the passing target.

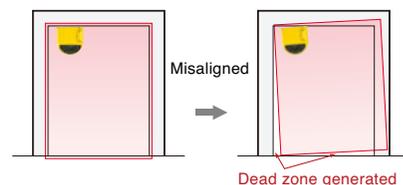


## Maintain safe conditions even after unexpected misalignment Reference Point Monitoring function

SZ-01S

SZ-04M

For vertical guarding (access protection), reference points are required to prevent changes from creating an unsafe condition (e.g. removal of a door or hard guard, unintended or even deliberate misalignment of the scanner). Configuring reference points with our user-friendly software can be done in seconds. If the reference points are breached, a stop signal is sent, preventing a potentially unsafe situation. (Reference Point Monitoring function)



## Can be easily installed anywhere due to its light-weight and super-compact body

SZ-01S

SZ-04M

The SZ Series installs easily for vertical guarding or access protection applications. Compared to conventional scanning devices, the SZ offers smaller overall footprint and lighter weight, enabling simple installation. A variety of mounting brackets are available to help reduce installation time for any application, vertical or horizontal. (For details, see P. 11)

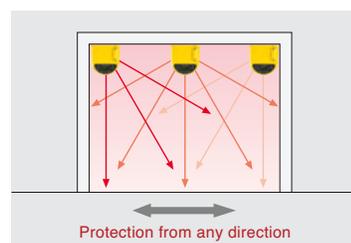


## Can be placed in almost any position to guard the desired area

SZ-01S

SZ-04M

Configuring zones with conventional scanners is unforgiving and inflexible. The simple, intuitive drawing tools of the SZ Configurator software make it easy to create protection zones to the left, right or directly along the scanner's centerline. This allows the user to choose the most convenient location to mount the scanner.



# Collision Prevention

A type 3 safety laser scanner can be mounted on an automated guide vehicle.

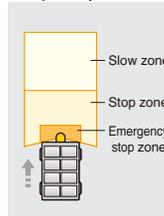


## Up to 16 zone sets (banks) with 3 zones for a total of 48 zones can be configured

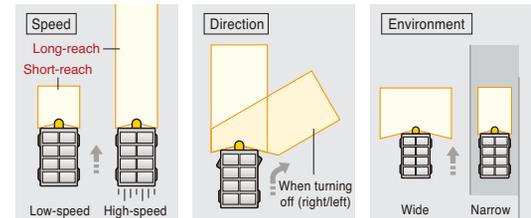
SZ-16V

One protection zone (emergency stop) and two warning zones (stop/slow), 3 zones in total, can be configured per zone set (bank) and up to 16 zone sets (banks) can be configured. External inputs enable simple switching between the 16 zone sets according to the speed, direction, and environment.

3 zones for 1 zone set (bank)



Example of zone set (bank) switching pattern



## Distance based detection detects even matte black targets

SZ-01S SZ-04M SZ-16V

Conventional obstacle detection could fail due to something as simple as wearing a dark pair of pants. The SZ Series ensures reliable detection by limiting the influence of color and surface finish.



No need to worry about dark colored work clothes.

# User-friendly operation and diagnostics

## Simultaneous control of two individual protection zones One unit provides the capability of two devices

Industry's First

SZ-04M

Unlike conventional scanners which use a single set of safety signals (OSSD1,2) requiring external input signals to toggle between protection zones, the SZ-04M features true simultaneous protection of two independent zones. No switching is required since two sets of safety signals (OSSD1,2 and OSSD3,4) are provided.

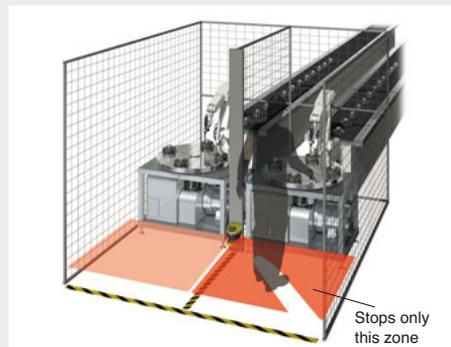
### Protection zone 1

OSSD output 1  
OSSD output 2

### Protection zone 2

OSSD output 3  
OSSD output 4

\* Independent EDM and Reset inputs are also available for each zone.



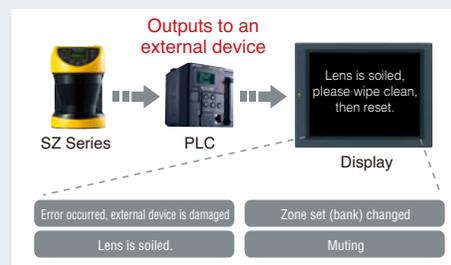
## Sends the current status to external devices State Information Output

Industry's First

SZ-04M

SZ-16V

This function can send a signal to a PLC or other non-safety device for the intent of displaying real-time status information on an HMI or other interface. For example "Lens is soiled, please wipe clean, then reset" or "EDM Error. Please check external devices".



## Protection zones/warning zones can be configured with just the main unit, without the need for a PC

Industry's First

SZ-01S

SZ-04M

Rectangular zones can be configured without a PC through the information display. Configuration is easy and it is no longer necessary to bring a PC for on-site operation.



### OPERATING PRINCIPLE

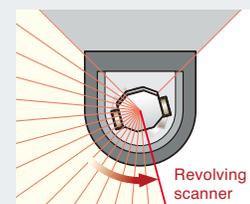


#### Distance measurement using the TOF (Time of Flight) method

Calculates the time during which a pulse-emitted beam returns after hitting the detection target.

#### Measurement at high-resolution of 0.36° pitch

270° range is measured in a radial fashion using the TOF method at 0.36° pitch by revolving the internal reflective mirror at the speed of 30 ms/per revolution.



# The easiest, most intuitive, step-by-step scanner configuration software you will ever use

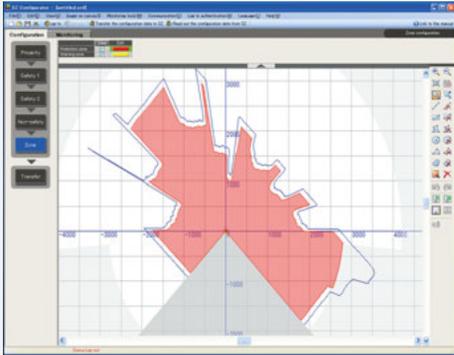
**SZ-H1S configuration software is fast, easy, and loaded with useful, time-saving tools**

SZ-01S SZ-04M SZ-16V



### Automatic-Drawing function

For the ultimate in ease of use, simply mount the SZ in the desired location, clear the area, and click the "Automatic Drawing" tool. Immediately the SZ draws a zone around existing obstacles.



### Setup navigation function

Guides the user through a step-by-step setup of functions.

## OTHER FUNCTIONS

Industry first

### Suspension in Teaching mode

This function temporarily overrides safety functions during the robot's "teach" mode. It can only be activated when the SZ receives the teach mode signal from the robot.

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### Interference reduction function

The SZ Series has two scanning cycles, which makes it possible to reduce mutual interference between the SZs installed face-to-face.

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### Output connectable to either NPN/PNP

Regardless of the OSSD output type (NPN, PNP) being used, all non-safety outputs can be wired for either NPN or PNP operation depending on input device polarity.

**Main Unit** \* Cables and brackets are not included. Select separately.

Appearance	Type	# of zone sets (# of banks)	Model	Weight
	Simple function type 	1	SZ-01S	Approx. 1.6 kg
	Multi-function type 	4	SZ-04M	
	Multi-zone sets (banks) type 	16	SZ-16V	

## Cable

Appearance	Compatible With	Length	Output	Model	Weight
	SZ-01S	5m 16.4'	PNP	SZ-P5PS	Approx. 280g
			NPN	SZ-P5NS	
		10m 32.81'	PNP	SZ-P10PS	Approx. 530g
			NPN	SZ-P10NS	
	20m 65.62'	PNP	SZ-P20PS	Approx. 1,040g	
		NPN	SZ-P20NS		
SZ-04M SZ-16V	5m 16.4'	PNP	SZ-P5PM	Approx. 360g	
		NPN	SZ-P5NM		
	10m 32.81'	PNP	SZ-P10PM	Approx. 720g	
		NPN	SZ-P10NM		
20m 65.62'	PNP	SZ-P20PM	Approx. 1,400g		
	NPN	SZ-P20NM			

\* Connector colors; PNP:Black, NPN:Gray

## USB Cable (Optional)

Appearance	Name	Length	Model	Weight
	USB cable 5m 16.4'	5m 16.4'	OP-86941	Approx. 200g

## PC Software (Standard accessory)

Name	Model	Weight
SZ Series Configuration Software	SZ-H1S	Approx. 80g

## Brackets (Appearance when mounted)

### Standard mounting bracket



### Mounting bracket with angle alignment



## Mounting bracket (Optional)

### Standard mounting bracket

Appearance	Type	Model	Weight
	Horizontal mounting bracket	OP-86935	Approx. 250g
	Vertical mounting bracket	OP-86936	Approx. 180g

### Mounting bracket with angle alignment

Appearance	Type	Model	Weight
	Horizontal mounting bracket with angle alignment	OP-86937	Approx. 690g
	Vertical mounting bracket with angle alignment	OP-86938	Approx. 850g
	L-shaped mounting bracket with angle alignment	OP-86939	Approx. 960g

# Specifications

**Type3** **SIL2** **Category3** **PLd**

Model		SZ-01S	SZ-04M	SZ-16V	
Type		Simple function type	Multi-function type	Multi-zone sets (banks) type	
Detection capability	Minimum detectable object size	Diameter 1.18" 30 mm/1.58" 40 mm, 1.97" 50 mm, 2.56" 70 mm, 5.91" 150 mm (depends on the setting) Reflectance 1.8% min., Speed 5.25 ft/s 1.6 m/s max.			
	Detectable angle	270° (-45° to 225°)			
	Response time (ON to OFF)	General scan cycle (Scan cycle A)	60 ms (2 scanning) to 480 ms (16 scanning)		
		Specific scan cycle (Scan cycle B)	66 ms (2 scanning) to 528 ms (16 scanning)		
	Response time (OFF to ON)	General scan cycle (Scan cycle A)	Response time of ON to OFF + 125 ms		
		Specific scan cycle (Scan cycle B)			
	Max. protection zone	Minimum detectable object size: 2.76" 70 mm/5.91" 150 mm	13.78' 4.2 m (-5° to 185°), 9.19' 2.8 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 1.97" 50 mm	9.84' 3.0 m (-5° to 185°), 6.56' 2.0 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 1.58" 40 mm	7.87' 2.4 m (-5° to 185°), 5.25' 1.6 m (-45° to -5°, 185° to 225°)		
		Minimum detectable object size: 1.18" 30 mm	5.91' 1.8 m (-5° to 185°), 3.94' 1.2 m (-45° to -5°, 185° to 225°)		
Max. warning zone (non safety related)*1	Minimum detectable object size: 2.76" 70 mm/5.91" 150 mm	32.18' 10.0 m (-5° to 185°), 22.97' 7.0 m (-45° to -5°, 185° to 225°)			
	Minimum detectable object size: 1.97" 50 mm	24.61' 7.5 m (-5° to 185°), 16.4' 5.0 m (-45° to -5°, 185° to 225°)			
	Minimum detectable object size: 1.58" 40 mm	19.69' 6.0 m (-5° to 185°), 13.12' 4.0 m (-45° to -5°, 185° to 225°)			
	Minimum detectable object size: 1.18" 30 mm	14.76' 4.5 m (-5° to 185°), 9.84' 3.0 m (-45° to -5°, 185° to 225°)			
Additional safety distance	3.94" 100 mm *2				
Light source	Type, wavelength	Infrared laser diode, 905 nm			
	Laser class	Class 1 IEC / EN 60825-1: 2007 Class 1 CFR 21 1040.10, 1040.11 (Laser Notice No.50) Class 1 JIS C6802: 2005			
Rating	Power voltage	24 V DC ±10% (Ripple P-P 10% or less): When using a converter power supply 24 V DC +20%/-30%: When using a battery			
	Power consumption	Max. 9.5 W (without load) Max. 39W (with load)	Max. 9.5 W (without load) Max. 50W (with load)	Max. 10.5 W (without load) Max. 43W (with load)	
OSSD output	Output	PNP or NPN (Selectable according to the connector cable)			
		2 outputs	4 outputs	2 outputs	
	Max. load current	500mA*3			
	Residual voltage (during ON)	Max. 2.5 V (with a cable length of 16.4' 5 m)			
	OFF-state voltage	Max. 2.0 V (with a cable length of 16.4' 5 m)			
	Leakage current	Max. 1 mA *4			
	Max. capacitive load	2.2 µF (with a load resistance of 100Ω)			
Load wiring resistance		Max. 2.5Ω *5			
Input (safety-related)	Input resistance	4.4 kΩ (for Input 1) 2.2 kΩ (for Input 2)	4.4 kΩ (for Input 1,3, 4, and 5) 2.2 kΩ (for Input 2 and 6)	4.4 kΩ (for Input 1 and 3 to 10) 2.2 kΩ (for Input 2)	
Non safety-related output (AUX output)	Output	PNP/NPN totem pole output			
		2 outputs	6 outputs	4 outputs	
	Max. load current	50mA			
	Residual voltage (during ON)	Max. 2.5 V (with a cable length of 16.4' 5 m)			
Muting lamp output	(AUX6 output can be assigned for the muting lamp output)		Can be connected to the incandescent lamp (24V DC, 1 to 5.5W) and LED lamp (load current 10 to 230 mA)		
Environmental resistance	Enclosure protection	IP65 (IEC60529)			
	Operating ambient temperature	-10 to +55°C (No freezing) 14 to 131°F			
	Storage ambient temperature	-25 to +60°C (No freezing) -13 to 140°F			
	Operating relative humidity	35 to 85% RH (No condensation)			
	Storage relative humidity	35 to 95% RH			
	Surrounding light	Incandescent lamp: 1500 lx or less *6			
	Vibration	10 to 55 Hz, 0.7 mm compound amplitude, 20 sweeps each in X, Y, and Z directions			
	Shock	100 m/s <sup>2</sup> (Approx. 10 G), 16 ms pulse in X, Y, Z directions, 1,000 times each axis			
Material	Main unit case	Aluminum die casting, SPHC (Bottom)			
	Window	Polycarbonate			
Cable length		65.62' 20 m or less *7			
Approved standards	EMC	EMS	IEC61496-1, EN61496-1, UL 61496-1		
		EMI	EN55011 Class A, FCC Part15B Class A		
	Safety		IEC61496-1, EN61496-1, UL 61496-1 (Type 3 ESPE) IEC61496-3, EN61496-3 (Type 3 AOPDDR) IEC61508, EN61508, IEC62061, EN62061 (SIL2) EN ISO13849-1:2006 (PL d, Category 3) UL508, UL1998		

\*1 20% or more reflectance is necessary for the minimum detectable object in the warning zone.

\*2 If there is a high reflective background within 49.21' 1.5 m from the boundary of the protection zone, 7.87' 200 mm must be added as supplementary necessary distance to the protection zone in case of calculation of the minimum safety distance.

\*3 The total load current of the OSSD output and the AUX output must be 1.5 A or less in case of the converting equipment for power supply, while it must be 1.0 A (0.5 A with 16.4' 5m of cable length) or less in case of the battery.

\*4 This also takes into account the situations when power is either off or disconnected.

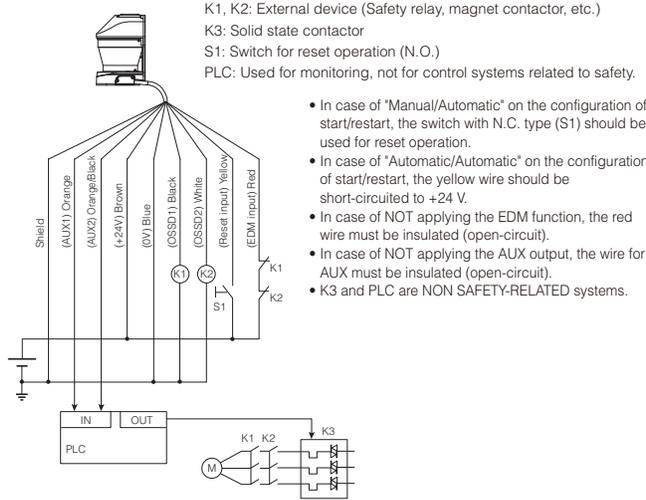
\*5 The wiring resistance between the OSSD output and the connected equipment (excluding the resistance of the cable) must be 2.5 Ω or less to ensure operation. However, it must be 1.0 Ω or less if the load current is 300 mA or more.

\*6 The SZ should not be installed so as to have light interference within ±5° to the detection plane.

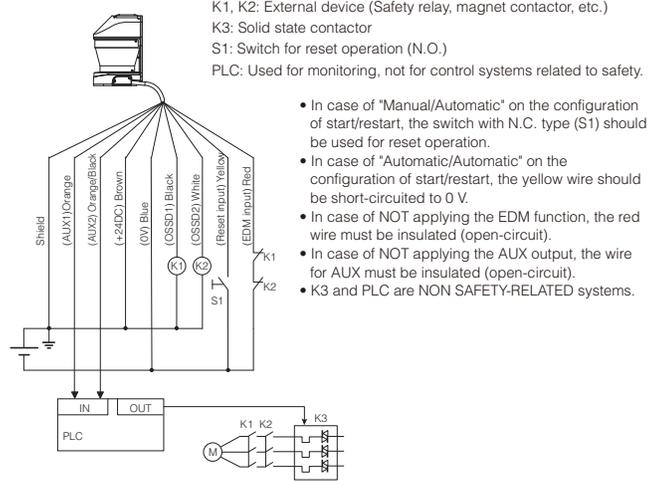
\*7 It must be 32.81' 10 m or less if the power is supplied by the battery.

## Example of wiring for simple function type (SZ-01S) Configuration of start/restart mode: Manual/Manual

For the PNP output type cable



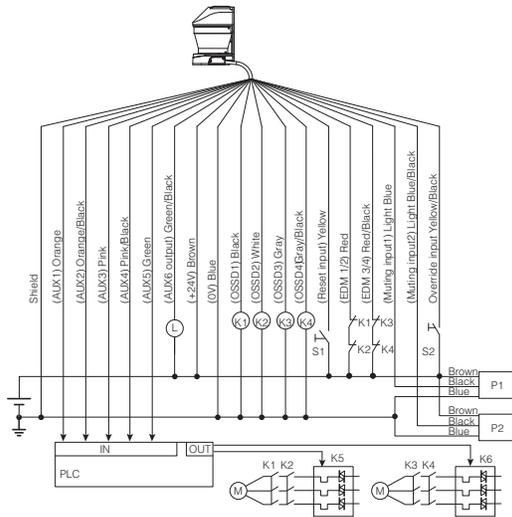
For the NPN output type cable



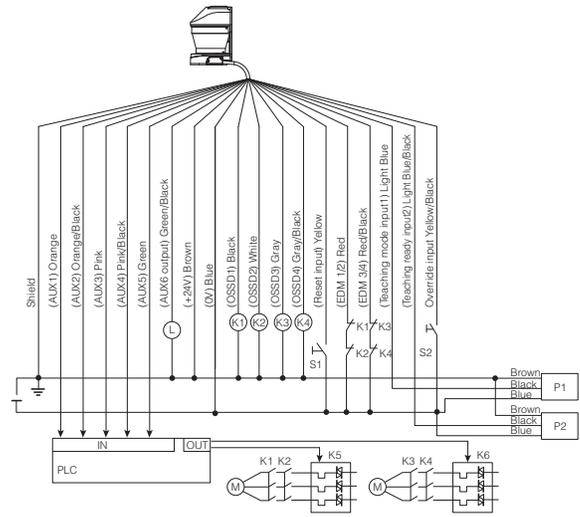
## Example of wiring for multi-function type (SZ-04M)

Multi-OSSD function: Mode A, B, C and Not use, configuration of start/restart mode: Manual/Manual in case of applying the muting function

For the PNP output type cable



For the NPN output type cable



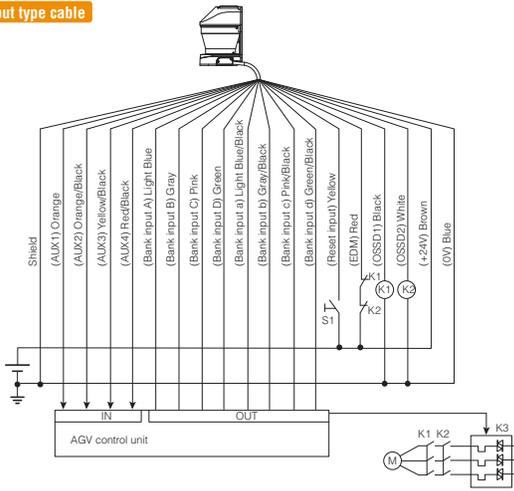
K1, K2, K3, K4: External device (Safety relay, magnet contactor, etc.)  
K5, K6: Solid state contactor  
S1: Switch for reset operation (N.O.)  
S2: Switch for override (N.O.)  
PLC: Used for monitoring, not for control systems related to safety.  
P1, P2: Muting devices (ex. PZ series with PNP output, Keyence Corp.)  
M: 3-phase motor  
L: Muting lamp

- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, yellow wire should be short-circuited to +24 V.
- When "Not use" is applied as the operation mode for OSSD3/4, the gray and gray/black wire must be insulated (open-circuit)
- In case of NOT applying the EDM function, both red wire and red/black must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K5, K6 and PLC are NON SAFETY-RELATED systems.

K1, K2, K3, K4: External device (Safety relay, magnet contactor, etc.)  
K5, K6: Solid state contactor  
S1: Switch for reset operation (N.O.)  
S2: Switch for override (N.O.)  
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P1, P2: Muting devices (ex. PZ series with NPN output, Keyence Corp.)  
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L: Muting lamp

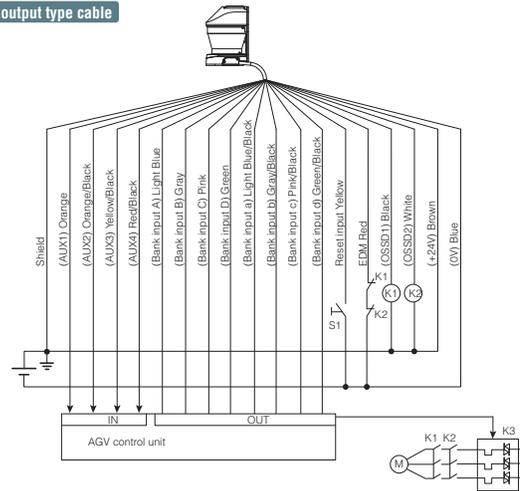
- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
- In case of "Automatic/Automatic" on the configuration of start/restart, yellow wire should be short-circuited to 0 V.
- When "Not use" is applied as the operation mode for OSSD3/4, the gray and gray/black wire must be insulated (open-circuit)
- In case of NOT applying the EDM function, both red wire and red/black must be insulated (open-circuit).
- In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
- K5, K6 and PLC are NON SAFETY-RELATED systems.

**For the PNP output type cable**



- K1, K2: External device (Safety relay, magnet contactor, etc.)  
 K3: Solid state contactor  
 S1: Switch for reset operation (N.O.)
- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
  - In case of "Automatic/Automatic" on the configuration of start/restart, yellow wire should be short-circuited to +24 V.
  - In case of NOT applying the EDM function, red wire must be insulated (open-circuit).
  - In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
  - K3 is NON SAFETY-RELATED system.

**For the NPN output type cable**

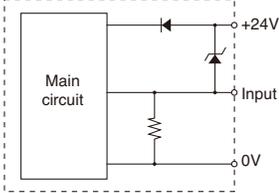


- K1, K2: External device (Safety relay, magnet contactor, etc.)  
 K3: Solid state contactor  
 S1: Switch for reset operation (N.O.)
- In case of "Manual/Automatic" on the configuration of start/restart, the switch with N.C. type (S1) should be used for reset operation.
  - In case of "Automatic/Automatic" on the configuration of start/restart, yellow wire should be short-circuited to 0 V.
  - In case of NOT applying the EDM function, red wire must be insulated (open-circuit).
  - In case of NOT applying the AUX output, the wire for AUX must be insulated (open-circuit).
  - K3 is NON SAFETY-RELATED system.

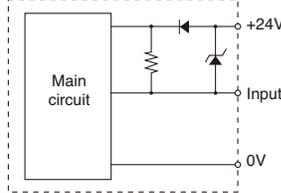
**Input / output circuit**

**Input circuit**

• For the PNP output type cable

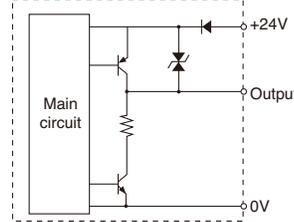


• For the NPN output type cable

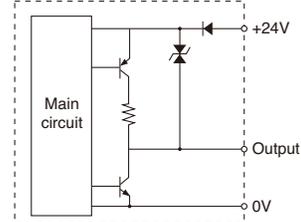


**OSSD output circuit (Safety output)**

• For the PNP output type cable

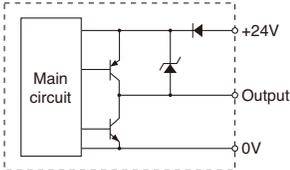


• For the NPN output type cable



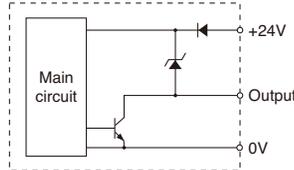
**AUX output circuit (Non-safety output)**

• Common for the PNP output type cable / NPN output type cable

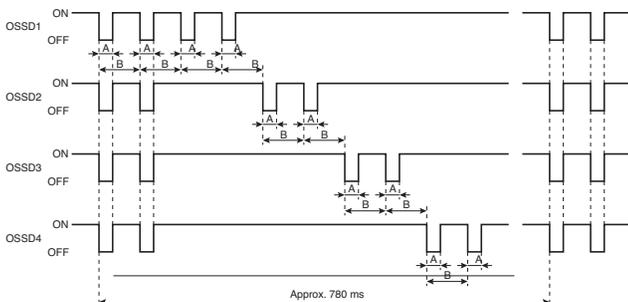


**Muting lamp output**

• Common for the PNP output type cable / NPN output type cable



**OSSD Time chart for self-diagnosis pulse**

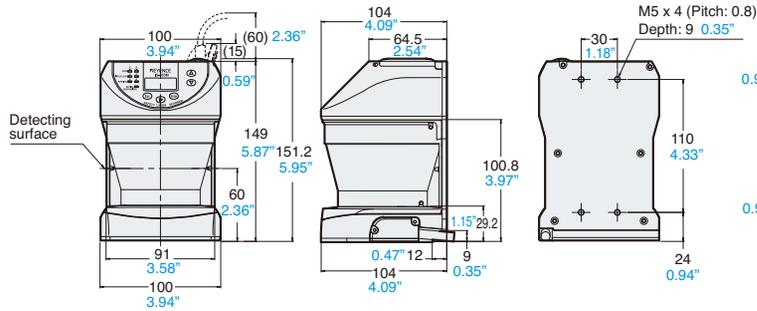
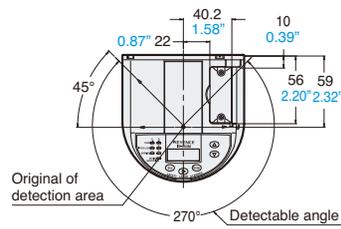


A : approx. 20 μs (If a capacitive load is connected, max. 200 μs can apply.)  
 B : approx. 30 ms

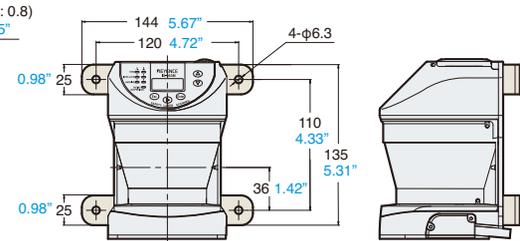
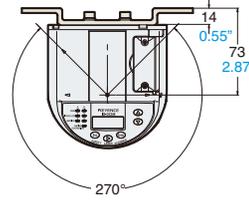
When the SZ detects an object (someone or something) in the protection zone, the OSSD goes to the OFF-state.  
 The OSSD is a safety output for safety-related part of a machine control system.  
 OSSD 1/2 is a pair of safety outputs that performs the output of same state. Similarly, OSSD 3/4 is also a pair of safety outputs that performs the output of same state.  
 The SZ generates self-diagnosis signals on its internal control circuit to perform diagnostics on the OSSD. These signals periodically force the OSSD into a temporary OFF-state when the OSSD is in the ON-state (when the SZ detects no object in the protection zone.).  
 The internal control circuit receives a feed-back signal (OFF-signal) based on the self-diagnosis, the SZ determines that its OSSD is in the normal operation. If the OFF-signal is not returned to the internal control circuit, the SZ determines that there is a problem in its OSSD or wiring and goes to the error state.

**NOTE** The devices connected to the OSSD, such as safety relay or contactor, should not respond to these temporary, self-diagnostic OFF-signals.

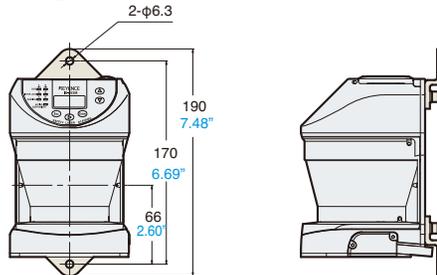
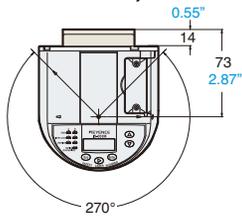
## SZ Main unit



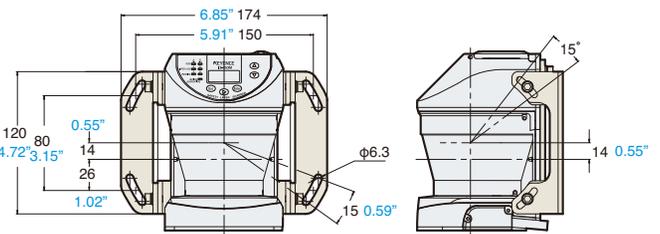
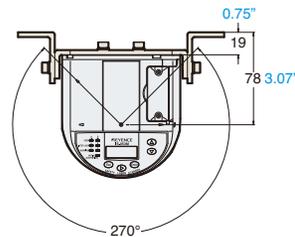
## Horizontal mounting bracket (Model: OP-86935)



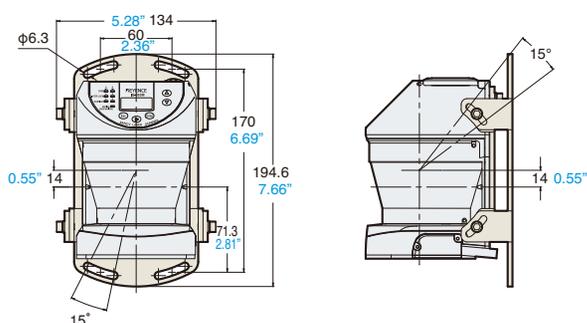
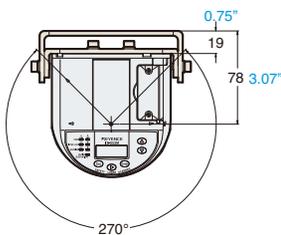
## Vertical mounting bracket (Model: OP-86936)



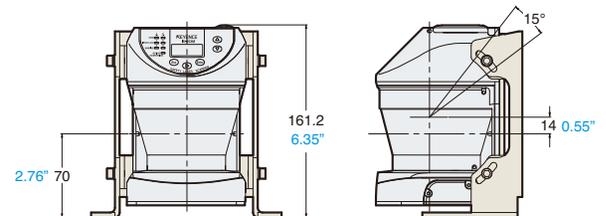
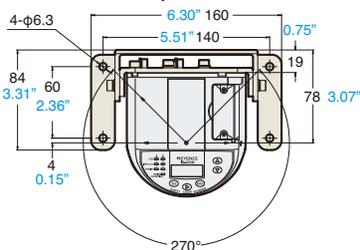
## Horizontal mounting bracket with angle alignment



## Vertical mounting bracket with angle alignment (Model: OP-86938)

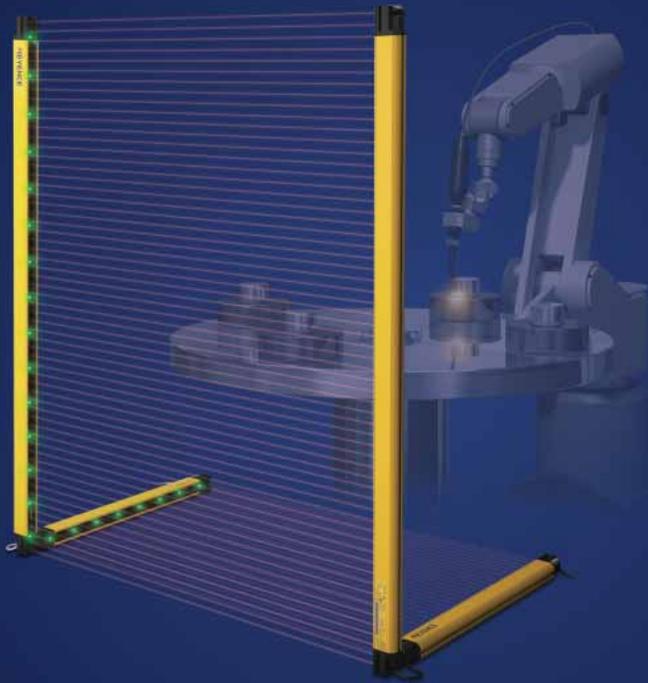


## L-shaped mounting bracket with angle alignment (Model: OP-86939)



Unit: mm inch

# Safety Light Curtain SL-V Series



With the new functions, it is no longer necessary to purchase an additional control unit. Functions like muting and beam axis intensity monitoring that used to be difficult or impossible, are now easy to setup using the software. As a result, on-site installation time will be greatly reduced.

## Programmable Muting function

Increase safety by muting specific beams according to target height



Clearance height 1

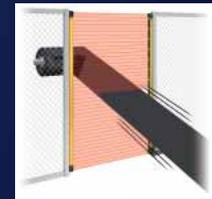


Clearance height 2

## Fixed Blanking function For Stationary Objects



## Floating Blanking function For Moving Objects



## Super Slim Line-up



SL-VF series

Minimum detectable object  
φ0.55"  
φ14mm



SL-VH series

Minimum detectable object  
φ0.98"  
φ25mm

## Super Heavy Duty Line-up



**NEW**  
SL-VFM series

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SL-VHM series

Minimum detectable object  
φ0.98"  
φ25mm

## Additional Equipment



**NEW**  
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SL-T11R



**NEW**  
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**NEW**  
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**NEW**  
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**SAFETY INFORMATION**  
Please read the instruction manual carefully in order to safely operate any KEYENCE product.

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